Catching Slough County Road Repair

Environmental Assessment
EA # OR-125-03-08
June 2, 2003
Coos Bay District
Bureau of Land Management

Chapter 1: Purpose of and Need for Action

1.1 *Proposed Action: Catching Slough County Road Repair*

The Coos County Road Department and the Coos Watershed Association propose to implement road maintenance activities along Catching Slough. There are three primary project components: repairing four road fill failures along East Catching Slough Road, replacing three field drain culverts under East Catching Slough Road, and replace/removing four culverts under East Catching Slough Roads and Old Wagon Road to enhance access to stream and wetland habitat.

The activities will occur during the dry season, generally July 1 through September 15.

This Environmental Assessment (EA) OR125-03-08 addresses the site specific, direct, indirect, and cumulative effects of this proposal.

1.2 *Need for the Catching Slough County Road Repair Project*

1.2.1 Road Fill Failure Remediation

East Catching Slough Road is notorious for its poor condition, partially as a result of road fill failures at four locations where the road acts as a dike between Catching Slough and adjacent properties. Fill failures have caused cracking and slumping in the pavement which requires frequent asphalt patching (repeated maintenance has resulted in asphalt depths of two to six feet in some places). Road conditions (poor pavement, lack of shoulders, curvy alignment) and proximity to water make East Catching Slough Road one of the most dangerous in the County transportation system.

1.2.2 Culvert Maintenance Upgrades

This project component involves replacing three culverts on East Catching Slough Road. All three County-owned culverts are rusted and leaking. Replacing these three failing culverts as part of this larger road upgrade project will reduce disturbance to the aquatic environment, lessen public inconvenience, and reduce potential fill failures resulting from collapsed pipes.

1.2.3 Fish Passage Enhancements

This portion of the project involves replacing four undersized, leaky County-owned culverts with new, larger culverts. The Coos Watershed Association, under a Memorandum of Agreement with Coos County, surveyed culverts at these sites in 2001. All culverts were recommended for replacement due to their poor condition, potential for erosion, and fisheries habitat located above the structures.

1.3 *Objectives of the Catching Slough County Road Repair Project*

Objective #1: Reduce future road maintenance liability as a result of failing fill and deteriorating culverts

Objective #2: Provide crucial estuarine rearing habitat for Coho salmon spawned on BLM and private lands

1.4 *Relevant Documents That Influence This Environmental Assessment*

The Oregon Department of Transportation (ODOT) *Routine Road Maintenance Water Quality and Habitat Guide Best Management Practices* is hereby incorporated by reference. This document describes the Best Management Practices to be used by the state when conducting road maintenance activities on public roads.

1.5 *Issues Eliminated From Further Study*

The Catching Slough County Road Repair Interdisciplinary Team (IDT) eliminated the following issues from detailed study, as directed by CEQ regulation §1500.1(b), 1500.2(b) and other sections, because the proposed project would have no effect or cause only inconsequential effects to occur to these issues. No further information on these eliminated issues appears in this environmental assessment. However, the EA Project File contains reports dealing with these eliminated issues.

1.5.1 Port-Orford Cedar

The project areas are located on agricultural lands and on portions of East Catching Slough Road and Old Wagon Road which are treeless. While the project area is within the natural range of POC, there is no POC present at any of the project sites. No POC was noted along any of the potential access sites.

1.5.2 Environmental Justice/ Native American Trust Resources

The proposed areas of activity are not known to be used by, or disproportionately used by, Native Americans, and minority or low-income populations for specific cultural activities, or at greater rates than the general population. The bureau of Land Management (BLM) concludes that no disproportionately high or adverse human health or environmental effects will occur to Native Americans, and minority or low-income populations as a result of any of the Alternatives, including the Proposed Action. The local Indian Tribes (Coos, Lower Umpqua and Siuslaw, and Coquille) have no known Indian Trust Resources in this county road.

1.5.3 Noxious Weeds

The predominant vegetation of the area is non-native species of grasses, other forbs, shrubs, and numerous noxious weeds species. These include broom species, thistle species, Himalayan blackberry, and tansy ragwort. As long as the Project Design Features are followed, the project is expected to neither increase nor decrease the presence of these noxious weeds within this watershed.

1.5.4 T & E Wildlife Species

There are no known occupied sites of listed species, critical habitat, or suitable habitat for listed species on BLM administered land within distances that would require seasonal or daily timing restrictions on any of the proposed projects. While surveys have not been conducted, the private lands adjacent to the project sites do not contain habitat conducive for the presence of any Threatened or Endangered wildlife species. The projects would not include removal of any suitable habitat for listed species.

1.6 *Decisions That Must Be Made*

The Field Manager of the Umpqua Resource Area, Coos Bay BLM, must decide whether to fund road maintenance projects within the Catching Slough Watershed. These projects are described in detail in Chapter 2.

The Field Manager must also determine if any of the alternatives would or would not constitute actions significantly affecting the quality of the human environment. If the Manager determines they would not significantly affect the quality of the human environment, then the Manager can prepare and sign a FONSI (Finding of No Significant Impact).

If the Manager determines that an alternative would significantly affect the quality of the human environment, then the alternative must either be dropped, modified or have an EIS (Environmental Impact Statement) and a ROD (Record of Decision) prepared and signed before the alternative could be implemented as part of the Catching Slough County Road Repair Project.

Chapter 2: Alternatives Including the Proposed Action

2.1 *Introduction*

This chapter describes the No-Action Alternative and three Action Alternatives. The descriptions also incorporate actions common to each action alternative.

This chapter is composed of the following three major sections:

- Alternatives Considered But Eliminated From Further Study
- Description of Alternatives and Actions Common to all Action Alternatives
- Description of Relevant Past, Present and Reasonably Foreseeable Actions Related to but Not Part of the Catching Slough County Road Repair Project

2.2 *Alternatives Considered But Eliminated From Further Study*

There were components of the Action Alternatives that had several design options. These include numerous types of tide gates and culvert materials. The tide gate design chosen is the most ecological and economical structure for this project. Refer to the Coos Watershed Association report in the EA Project file for more detailed analysis of tide gate types.

2.3 *Description of Alternatives*

2.3.1 Alternative A: No Action

- Under this alternative, there would be no maintenance activities to the Catching Slough County Road system.
  - The road fill failure sites would not be repaired. The currently gravel surfaced portions would not be paved, continuing to create a driving hazard. The slumping road fills would continue to drop down into the slough, potentially creating a major road failure if it collapses altogether.
  - Drainage culverts would not be replaced. These would continue to rust increasing pasture flooding and saturating the road fill, possibly to the point of collapse.
  - Fish passage tide gates and culverts would not be replaced. Additional estuarine rearing for salmonid species would not be opened.

2.3.2 Actions Common to All Action Alternatives

- Noah Sites: Three field drain culverts would be replaced. Tide gates are currently attached to two of the three pipes. These tide gates would be reinstalled on these two pipes.

- Fish Passage Site #1: A culvert with attached non-functional tide gate would be removed and a larger, aluminized pipe-arch would be installed lower in the road fill. Fish access to 0.25 miles of stream and 2 acres of wetland rearing habitat will be improved.

ÿ Fish Passage Site #2: Two culverts with heavy, wooden, top-hinged tide gates would be removed and replaced by one larger, round culvert with a lighter, "fish friendlier", side-hinged tide gate. The stream channel and ditch system upstream from these structures would be reconnected so that water would drain to a common outlet. The larger pipe and lighter tide-gate would improve drainage and facilitate passage of adult and juvenile fish.

ÿ Fish Passage Site #3: An existing round culvert would be replaced with a much larger aluminized pipe arch. The tide gate superstructure immediately downstream from the existing culvert would be removed and not replaced. The new culvert would improve juvenile access to an existing 14 acre wetland. An existing road to the south of the wetland and a dike to the north would be raised to the level of East Catching Slough Road to accommodate additional water within the wetland.

2.3.3 Alternative B: Proposed Action, County Proposal

ÿ This Alternative consists of first removing the current asphalt layers. Next, using pilings driven into the slough side of the road fill faced with a guard rail, and anchor pilings driven into the opposite side of the road fill, cables would be tied between the piling and pile anchors across the fill surface. Then the road surface would be reconstructed across the cable webbing.

2.3.4 Alternative C: Sheet Pile Retaining Wall

ÿ A vertical sheet pile retaining wall would be constructed between the road and the slough. Anchor pilings would be driven on the land side of the road and connected to the sheet piling with tie rods. The road fill would then be reconstructed.

2.3.5 Alternative D: Geo-Textile Fabric

ÿ Under this Alternative, fill material would be completely removed at each site down to an elevation below the existing mudflat. High strength geo-textile fabric would line the bottom of the excavated area, and rock would be placed on top of the fabric. Geogrids and fill would then be layered to reconstruct the road fill. This option would require a water control plan to keep the construction isolated from incoming tides.

2.3.6 Project Design Features – Action Alternatives

Design Features Applicable to All Alternatives

- Best Management Practices, as outlined in the ODOT Routine Road Maintenance Guide, would be followed. These include, but are not limited to, utilizing silt fencing and straw bales for project site erosion control, seeding and mulching all exposed soils, following Oregon Department of Fish and Wildlife (ODFW) in-stream work windows, and utilizing existing fill in construction to the maximum extent possible. Any removed fill material that is not immediately reusable would be stored at a stable location away from wetlands either near the project site or at the Coos County Enigren Rock Pit.

- Thorough subsurface investigations would be completed prior to implementation of any alternative.

- A water management plan would be developed before implementation of Alternative D (Geo-Textile Fabric) to mitigate diurnal tidal impacts on exposed soils.

- If any possible cultural resources are encountered during implementation, work in the vicinity would stop and the Coos Bay BLM District Archaeologist would be notified at once.

- A spill containment kit would be kept on site during equipment operations.

- Refueling of equipment would be kept as far as possible from the slough to prevent direct delivery of contaminants into the water.

- Equipment would be cleaned prior to mobilization to prevent the spread of noxious weeds.

2.4 Description of Relevant Past, Present, and Reasonably Foreseeable Actions Related but Not Part of the Catching Slough County Road Repair Project

There are other locations on these roads that are showing signs of wear. At any time in the immediate future these road areas may also need maintenance. Culverts may also need to be replaced.

Chapter 3: Affected Environment

3.1 *Introduction*

This chapter describes the existing condition of environmental resources within the Catching Slough watershed that would affect or that would be affected by the implementation of any of the Action Alternatives. The description of the existing conditions reflects the Application of Alternative A: No Action, and serves as the baseline for measuring the effects of the Action Alternatives.

3.2 *Description of Relevant Affected Resources*

3.2.1 Project Area Location

The Catching Slough project area is contained within the Coos Bay Regional Ecosystem Office 5th Field Watershed (USGS Hydrologic Unit Code (HUC) #1710030404) and the Isthmus Slough sub-watershed. The East Catching Slough Road (County Rd. 23) parallels the east bank of the slough. It runs in a north/south direction and connects the Coos River Highway to Sumner. The Old Wagon Road runs east from Ross Inlet, over the hill and then drops down along the west side of Catching Slough before connecting with East Catching Slough road at Seelander Creek and proceeding into Sumner.

The legal description of the project areas is Township 26 S., Range 12 W., Sections 8, 17, 20, and 29. The following map shows the locations of the individual project areas.

3.2.2 Human Environment

There are approximately 200 homes and approximately 600 residents that use the Catching Slough road network as their primary egress. Additionally, an unknown number of residential, commercial, and non-commercial vehicles may use these roads in their daily travels.

3.2.3 Water Quality – Bacteria

The Oregon Department of Environmental Quality (DEQ) is responsible for developing water quality standards that protect beneficial uses of surface water resources. The DEQ is also responsible for developing a list of water bodies that do not meet these standards. Catching Slough is currently listed twice for exceeding fecal coliform standards established to protect shellfish harvest and water contact recreation.

3.2.4 Hydrology – Floodplain Inundation and Flows

Catching Slough, its tributary stream channels, and associated floodplains have been modified to accommodate transportation and agriculture. Land use includes pastures, rural residential properties, and reverting wetlands upstream from breached dikes and failing drainage structures. Functional dikes that constrain Catching Slough from Sumner to the Coos River isolate floodplains from tide-borne sediment deposition, decrease floodwater storage capacity, and increase runoff velocity and flood peaks. These higher peak discharges increase erosion of the streambed and banks. Currently, Catching Slough is approximately 90% disconnected from its historical floodplain.

3.2.5 T & E Fish Species

Fish Species Occurrence
Fish species known or believed to occur in the Coos River watershed are:

Chinook salmon	Redside shiner
Coho salmon	Dace sp.
Steelhead trout	Pacific and Western brook lamprey
Sea-run and resident cutthroat trout	Sculpin sp.
Chum salmon	Striped bass
	American shad

All of the fish species listed above are believed to occur within the Catching Slough watershed. As the project areas are on Catching Slough itself, it is safe to assume that at any given time many of the above species may be present within the slough.

The Coos River 5th field watershed is located within the Oregon Coast (OC) Evolutionary Significant Unit (ESU), which extends south of the Columbia River to Cape Blanco. The following summarizes the Endangered Species Act (ESA) status of salmonids within the ESU:

- OC coho salmon were listed as "threatened" on August 10, 1988, and Critical Habitat was designated February 16, 2000. However, in September 2001, the US District Court for the District of Oregon (Judge Hogan) determined that the listing was unlawful and it was set aside as being arbitrary and capricious (*Alsea Valley Alliance v. Evans*). Hogan wrote that the listing by the National Marine Fisheries Service (NMFS) arbitrarily excluded hatchery spawned coho.

In review of Judge Hogan's ruling, the Ninth Circuit Court of Appeals issued a stay on December 14, 2001. This decision will remain in place until the Court makes a final ruling, which could be months or years. At the time of the writing of this EA, the listing of coho salmon as "threatened" has been reinstated.

In response to the *Alsea Valley Alliance v. Evans* September ruling, on February 11, 2002, the NMFS decided to review 24 ESUs currently listed as endangered or threatened. This review includes the OC coho salmon ESU. The current listing status for these species will remain in effect until the review is concluded.

- Steelhead trout were listed as "candidate" species on March 19, 1998. Critical habitat is not designated for candidate species.

- On April 5, 1999 the Oregon Coast coastal cutthroat ESU was designated as a "candidate" for listing. This species is under the jurisdiction of the U.S Fish and Wildlife Service.

3.2.6 Soils/Sediment

All but two of the road sites are located within the Coquille Silt Loam classification of soils. These particular soils have the highest component of clay (up to 65% at a depth of 60 inches) of all the soil types. All of the projects are located within artificial fill as opposed to native material. While subsurface investigations have not been conducted, field investigations suggest that the dike materials consist of silts taken from the riverbed load, adjacent lands, or a combination of both.

3.2.7 Geology

The project areas are located in the Coos Basin; with an Anticline/Syncline complex (i.e. there are numerous faults due to tectonic movement). The underlying bedrock layers consist of sedimentary materials including mudstone, siltstone, minor sandstone, coal, and minor conglomerate. Overlying these bedrock members are alluvium and estuarine deposits of sand, silt, peat, and clay. It cannot be stated at this time the amount or depth of the deposits built up over the bedrock.

3.2.8 Economics

Budget and workload constraints have forced the Coos County Road Department to make temporary, piecemeal repairs to deteriorating roads and culverts along Catching Slough. Further deterioration will continue to stretch County resources and may even prompt emergency repairs making it necessary to limit or reroute traffic.

Chapter 4: Environmental Consequences

4.1 *Introduction*

This Chapter is organized by the resources listed in Chapter 3.

Analysis of the No Action and three Action Alternatives has shown no impacts to Areas of Critical Environmental Concern (ACEC), Prime or Unique Farmlands, Wild and Scenic Rivers, Wilderness Values, Air Quality, Wildland Fire, or T & E Botanical Species.

4.2 *Effects to/from Alternatives A-D : Human Environment (Safety)*

4.2.1 Alternative A- No Action

4.2.1.1 Direct/Indirect/Cumulative

These roads and the culverts underneath them would continue to deteriorate. The Coos County Road Department would continue to make spot repairs to the most degraded portions of the Catching Slough road network. The quickly deteriorating condition of these roads, combined with adverse weather conditions could result in increased vehicular accidents along this road system.

4.2.2 Alternatives B, C, D – Action Alternatives

4.2.2.1 Direct/Indirect/Cumulative

Before construction begins, residents would be notified of the upcoming project work through press releases in the local newspaper, on radio stations, and on the local television station. A week before construction commences, signs describing the road closures would be posted at both ends of the road segments. The Sheriff's Office would also be notified before construction begins so that Emergency Response Activities may be coordinated around the road closures. There is enough space between the construction sites and overhead power lines that residents would not have an interruption in their electricity needs. During construction, users of these roads would be detoured as needed.

By implementing any of the Action Alternatives, the currently deteriorating portions (road fills and culverts) of the Catching Slough road network would be repaired. This would increase the overall safety of these roads by reducing the possibility of a road/culvert failure.

4.3 *Effects to/from Alternatives A-D : Water Quality-Bacteria*

4.3.1 Alternative A – No Action

4.3.1.1 Direct/Indirect

Existing wetlands at Fish Passage Sites #1 and #3 would continue to act as sources and sinks for fecal coliform bacteria. High tides combined with high runoff would continue to raise water levels enough to flush fecal matter from the marsh surfaces at both locations. At Fish Passage Site #2, Noah Site #2, and Noah Site #3, pasture flooding increases the chance of flushing livestock/wildlife waste into Catching Slough. Minor erosion at the toe of the Road Fill Failure Sites would likely not affect ambient bacterial concentrations.

4.3.1.2 Cumulative

Potential increases in bacterial levels as a result of road fill/culvert collapse would depend upon the timing and magnitude of each failure. Catastrophic winter collapse would expose more ground to flushing and mobilize a large amount of road fill and channel substrate. However, the higher flows would quickly dilute bacterial concentrations.

4.3.2 Alternatives B, C, D – Action Alternatives

4.3.2.1 Direct/Indirect

Establishing more natural flow in the tidally influenced wetlands at Fish Passage Sites #1 and #3 may initially produce higher fecal coliform concentrations within Catching Slough as fecal matter deposited from livestock and wildlife is flushed into the slough. During early winter storms, more marsh surface would be covered at a greater depth, increasing the chance of mobilizing these fecal accumulations. Because the Fish Passage Sites drain less than three percent of the entire Catching Slough watershed, project related fecal coliform contributions would be comparatively minor. For the Road Fill sites, the minor erosion of sediment displaced during construction would have no effect on the current fecal coliform bacteria levels.

4.3.2.2 Cumulative

The restoration of full tidal flow to the existing wetlands may attract more waterfowl and other wildlife. Although this would result in the accumulation of more animal feces, these contributions would be minimal at the watershed scale (wetland surface area accounts for less than one tenth of total watershed area).

4.4 *Effects to/from Alternatives A-D : Hydrology – Floodplain Inundation and Flows*

4.4.1 Alternative A: No Action

4.4.1.1 Direct/Indirect/Cumulative

Undersized drainage structures at Fish Passage Sites #1 and #3 would continue to delay the exchange of water and limit the volume of water flowing between Catching Slough and the wetland areas. Currently, the floodwater storage capacity of the wetlands is under-utilized because of these structures. At the Noah Sites and Fish Passage Site #2, poor drainage and pasture flooding would continue due to the inefficient tide gates and leaking, undersized culverts. The current incremental slumping of the Road Fill Failure Sites is not large enough to constrict the slough and change flow timing or magnitude. Road fill failure would deliver erodible material to the slough, but drainage flow and timing would remain unaffected.

4.4.2 Alternatives B, C, D – Action Alternatives

4.4.2.1 Direct/Indirect

The installation of large, pipe-arch culverts at Fish Passage Sites #1 and #3 would allow full tidal inundation of existing wetland areas. At Site #3, this would equate to minimum floodwater storage increase of 42 acre-feet[1]. Installation of an aluminum side-hinged tide gate at Fish Passage Site #2 would improve pasture drainage and minimize water velocity at the structure. Turbulence associated with high velocity flow would be reduced with the new structure.

Alternative B (County Proposal) and Alternative C (Sheet Piling) will reduce the cross-sectional area of the slough less than Alternative D (Geo-textile Fabric). This latter alternative would not only affect the width of the slough but also the depth (reconstructed fill would extend out onto the mudflat). Consequently, for discharges deep enough to cover the mudflats, average water velocity in Catching Slough at the project site would be greater following implementation of Alternative D. This increased water velocity could cause some minor erosion of the newly filled area or scouring of the existing stream channel.

4.4.2.1 Cumulative

The restoration of the tidal connection into the two wetland areas, along with reclamation of another 5-7% of historic wetlands within the watershed, would increase the overall flood storage capacity of Catching Slough. Because the area affected by treating road fills is small relative to the length of tidally influenced channel in the Catching Slough drainage, none of the alternatives would likely produce measurable changes in the overall timing and magnitude of flows.

[1] An acre-foot is equivalent to the volume of water that would cover one acre of land (43,560 square feet) to a depth of one foot. An acre-foot is equivalent to 325,851 gallons of water.

4.5 *Effects to/from Alternatives A-D : T & E Fish Species*

4.5.1 Alternative A : No Action

4.5.1.1 Direct/Indirect/Cumulative

There would be no increase in rearing habitat as wetlands would remain disconnected, culverts would continue to deteriorate, and tide gates would continue to prevent juvenile passage into stream channels. There would still continue to be sediment influxes as road fills erode and culverts collapse.

4.5.2 Alternatives B, C, D – Action Alternatives

4.5.2.1 Direct

Construction of any portion of any Action Alternative would create a short localized disturbance to fish species present in the project areas. This disturbance would be either noise or temporary passage restriction in combination with temporary sediment delivery depending upon the specific activity.

4.5.2.2 Indirect

With the first winter rains, any disturbed ground that has not been re-vegetated would input some sediment into the Catching Slough system. As to whether this would be in large enough quantities to affect migrating fish, is unknown; but expected to be unlikely.

Although one culvert structure will maintain a tide gate, the design of the tide gate would allow it to function in a more "fish friendly" manner. Tide gates impact different life stages of fish in many different ways; velocities and turbulence at openings hinder juvenile passage while the large amount of time the gate is closed restricts passage for adults. The new, side-hinge design is expected to remain open for longer periods of time and therefore reduce both physical and behavioral barriers to fish passage.

4.5.2.3 Cumulative

The long-term net gain in access to wetland habitat would be more beneficial to the overall health of fisheries populations than the localized, short term impacts from the project construction itself. The removal of two tide gates and installation of a fish-friendly tide gate at Fish Passage Site #2 would allow this long-term gain to occur.

4.6 *Effects to/from Alternatives A-D : Soils/Sediment*

4.6.1 Alternative A : No Action

4.6.1.1 Direct/Indirect

At the culvert sites, localized bed erosion would continue. Incremental slumping (inches per year) at the Road Fill Failure sites would continue to deliver minor amounts (<10 cubic yards) of erodible material to the outside edge of meander bends along Catching Slough.

There would be no effect to existing soil conditions as the projects are not in native soils.

4.6.1.2 Cumulative

Total loss of the entire road fill at the Fish Passage Sites is possible in the next decade given the inadequately sized and deteriorating corrugated metal culverts. Road fills would continue to fail. A catastrophic failure at either the Fish Passage Sites or the Road Fill Failure Sites would input enough material to constrict the slough until the material was excavated or eroded by the action of the water. Concentrated flow following the deposition of large masses of sediment would cause localized bank stability.

There would be no effect to existing soil conditions as the projects are not in native soils.

4.6.2 Alternatives B, C, D : Action Alternatives

4.6.2.1 Direct/Indirect

Fish Passage Sites: Application of project design features and the use of Best Management Practices during project implementation would minimize construction related sedimentation and turbidity. Once vegetation is established, there would be negligible erosion.

Road Fill Failure Sites: Application of project design features and the use of Best Management Practices during project implementation would minimize construction related sedimentation and turbidity for all proposed action alternatives. Alternative D (Geo-textile Fabric) would result in the most short term channel disturbance due to the need to de-water the site and place rock fill below the existing bed of the mudflat. Minor post-project sedimentation would also occur with this alternative because the fill slope along the inboard side of the road would be exposed to tidal flows prior to establishment of vegetation.

4.6.2.1 Cumulative

Fish Passage Sites: Increasing the size of these culverts would reduce the potential for road fill failures immediately and over the life span of the structures. Possible large scale sediment delivery resulting from catastrophic road fill failure would be replaced with short term (1 to 3 years), low level (<50 cubic yards) sediment movement as alluvial channels get deeper and wider following the removal of undersized culverts. Scour in the immediate vicinity of the new culverts would be minimal because, unlike the existing pipes, the new drainage structures would pass water, bed load and floating debris with minor change in water surface elevation and flow pattern.

Road Fill Failure Sites: If Project Design Features are implemented and a water quality management plan is developed before implementing Alternative D (Geo-textile Fabric), there would be minimal sediment delivery to fluvial systems from the road construction.

4.7 *Effects to/from Alternatives A-D : Geology*

4.7.1 Alternative A : No Action

4.7.1.1 Direct/Indirect/Cumulative

This alternative would have minimal direct/indirect/cumulative impacts on existing geologic conditions. Natural geologic processes would continue (e.g. earthquakes, tsunamis, etc.).

4.7.2 Alternative B (County Proposal) and C (Sheet Piling)

4.7.2.1 Direct/Indirect

These alternatives would have minimal direct and indirect impacts on existing geological conditions. However, the geology may have impacts on these alternatives. Subsurface geologic conditions (depth to bedrock) would determine the type of piling to be used. Thickness of silt, sand, and clay could make obtaining bedrock difficult which would require the use of friction pilings and require more engineering to determine the structural competence of using these structures.

4.7.2.2 Cumulative

As stated above, the structural integrity of the pilings is dependent upon subsurface geologic conditions. Piling choice will be determined following bedrock determination at each site. Additionally, by retaining the existing silt-based fill, the potential continues to exist for liquefaction of the road. However, this potential currently exists for any portion of the road as the road is constructed upon an old dike.

4.7.3 Alternative D (Geo-textile Fabric)

4.7.3.1 Direct/Indirect

This alternative would have minimal direct and indirect impacts on existing geologic conditions. Nor would the underlying geology have an effect on the design or construction of this alternative. By constructing the fill with new materials, the potential for liquefaction at these sites is reduced.

4.7.3.2 Cumulative

Stabilization of the road system and enhancement of the culverts would not impact the underlying stratigraphy in the aspects of geologic time. Earthquakes and the resulting impacts, including tsunamis and liquefaction, flooding, and other geologic hazards are part of the natural system and will continue at the present geologic rates.

4.8 *Effects to/from Alternatives A-D : Economics*

While the initial installation of the Road Fill Action Alternatives range from $150,000 (Alternative B: County Proposal) to $1,400,000 (Alternative C: Sheet Piling), Coos County Road Department annual maintenance costs would be reduced following project completion. Cost estimates for the Noah Sites and Fish Passage sites (combined) range from $70,000 to $85,000. These costs would be the same for each Action Alternative and are in addition to the costs given above for the Road Fill Failures.

Chapter 5: List of Preparers

Name	Title	Project Role
Aimee Hoefs	Natural Resource Specialist	Team Lead, Fisheries
Paul Slater	Environmental Planner- Coos County Highway Department	Project Proponent
Jon Souder	Executive Director – Coos Watershed Association	Project Proponent
John Colby	Hydrologist	Hydrology
Tim Barnes	District Geologist	Geology, Soils, Energy Development
John Chatt	Wildlife Biologist	Wildlife
Scott Knowles	Natural Resource Specialist	Noxious Weeds, Environmental Justice
Stephan Samuels	District Archaeologist	Cultural Resources, Native American Religious Concerns
Tim Votaw	HazMat Coordinator	Solid and Hazardous Waste
Tom Wilczek	District Engineer	Engineering